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Adoption of WLANS in the Hospitality Industry: A Theoretical Cost Analytic Framework

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ADOPTION OF WLANS IN THE HOSPITALITY INDUSTRY: A THEORETICAL COST-ANALYTIC FRAMEWORK

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Abstract

Wireless technologies are gaining popularity as a "trendy" solution to attract customers; many hospitality-related companies such as Starbuck's or McDonald's are trying to offer these services to their patrons (Wrolstad, 2004). While several hotel corporations are trying to jump on the bandwagon, there are a number of factors potentially influencing the decision of whether or not to implement wireless technologies in hotel properties. This research in progress paper provides an overview of the use of this technology in the hospitality industry. The paper uses a cost-theoretic model to analyze adoption decisions using social, technical, and organizational standpoints.

Keywords: Wireless, Hospitality Industry, Adoption.

1 INTRODUCTION

Scenario: Dallas, in summer. As every year, the beauty consultants of a large international cosmetics company meet to learn about new product lines, sales strategies, and marketing opportunities, and to celebrate successes of the past year. As usual, the annual meeting is organized to last over several weeks; during this time, beauty consultants from all over the U.S. come to attend seminars for a few days. Almost every day, long lines form in the hotel lobby due to the large number of arrivals and departures. As many guests do not check out until 2 or 3 p.m., guest rooms have not yet been cleaned for guests arriving early during the day. The housekeeping supervisors can only update the status of available rooms from their offices, therefore, the front desk is not informed about rooms that have been cleaned, if the status has not been updated. In addition to having to wait for a room, the long lines in the lobby create further guest dissatisfaction, as often departing and arriving guests have to wait in the same lines. In the evening, many of the guests try to call their loved ones at home from their rooms; as the hotel is fully booked and most rooms are occupied by multiple guests, trying to get an outside line is almost impossible, especially, as many guests use their laptop computers to dial up to their Internet service providers. On the day of departure, some of the guests try to leave early to catch the shuttle to the airport. Those who put some last-minute charges on their bills, for example by ordering room service breakfast, sometimes face incorrect bills, as the orders are not reflected in the system yet, which might lead to lost revenue potential or dissatisfaction.

Over the past decade, Internet usage has seen a tremendous growth; in addition to enhancing business processes, the Internet has enabled people to be connected in a wide variety of places. For business travelers, being online while on the road has become a necessity. Although hotels have begun to incorporate a data communication infrastructure for their guests, adoption of new technologies has remained sluggish at best (Namasivayam, Enz, & Siguaw, 2000).

In an attempt to reuse their telephony infrastructure, hotels used 56 Kbps dialup connections for data networking (Namasivayam et al., 2000). However, with increasing demand for bandwidth, hotel consulting companies argue that providing high-speed Internet access is "no longer 'optional'" for hotels (Hartmann, 2004). Hotels that had shied away from providing this service to their guests, for various reasons, e.g., having to upgrade the current telecommunications infrastructure, are finding themselves reluctant participants in a data communications infrastructure upgrade.

The dawn of wireless data communications ushered in a welcome reconciliation. Faster wireless networks and "thick" handheld clients that can process information independent of wireless networking technologies can help dealing with these problems while at the same time opening the door for a wide range of innovative uses for increasing revenue, increasing efficiency, and enhancing customer service (Namasivayam et al., 2000). Many instances of wireless technology adoption seem to be based solely on a bandwagon effect (Lacity & Hirschheim, 1993) rather than a serious investigation of underlying adoption factors. In that vein, we pose the following question: what are the factors inhibiting and promoting the adoption of wireless technologies in the hospitality industry?

This paper will examine the facilitators and inhibitors of wireless networking technology adoption in light of organizational, technical, and behavioral factors. In the next section, a short introduction to wireless technologies will be provided, including a discussion of potential applications in the hospitality industry, followed by a model of factors inhibiting and facilitating the widespread adoption of wireless networking in the hospitality industry. Subsequently, we will provide a cost-theoretic framework to analyze adoption decisions. Finally, future directions for research of wireless technologies in hotel properties and the implications for the industry will be provided.

2 WIRELESS NETWORKING

Wireless local area networks (WLANs) enable access to a network without being bound to physical data ports. Individuals equipped with the necessary hard- and software can access local area networks or connect to "the web" through wireless LANs. In order to establish a wireless network in a hotel property, an infrastructure consisting of wireless access points, routers/switches, and cabling (between the access points and routers) has to be set up; the WLAN then needs to be connected to the Internet (detailed descriptions of WLANs can be found elsewhere, e.g., Dennis, 2002). WLAN technologies offer a wide range of opportunities to address all three uses of technology in hotels (i.e., enhancing revenue, increasing efficiency, and providing guest service, Namasivayam et al., 2000).

2.1 Use of WLAN Technologies to Support Hotel Operations

A WLAN infrastructure throughout the hotel can be used to support hotel operations and at the same time increase perceived customer service. For example, several high-tech hotel properties have started to equip housekeeping supervisors and managers with handheld devices which can connect to the hotel's property management system (PMS) via a wireless interface. Provided with real-time data about vacant and occupied rooms, the managers can dispatch floor housekeepers more efficiently; in addition, the real-time connection to the PMS allows the managers to change the status of cleaned guest rooms without having to return to the office and process the status changes in batches, so that the front desk staff is able to assign rooms quickly after they have been cleaned by the housekeeping staff. In addition to improvements in efficiency, this system reduces the potential of complaints due to rooms not being cleaned at the time the new arrivals want to check in. Table 1 displays different uses of WLAN infrastructures in the hospitality industry.

Increase Efficiency	Provide Guest Service	Increase Revenue
Curbside check-in Use for bellpersons Use for housekeeping staff Use for room service	Provide high-speed Internet access Curbside check-in Use for bellpersons	Provide billed Internet access Use for upselling strategies

Table 1. WLAN Applications in the Hospitality industry

Due to the large number of arrivals and departures, the front desk at many hotels often reaches capacity during large conventions; even if there is sufficient staff available, there is a only a limited number of computer workstations, so only a fixed number of employees can work to check out departing and check in arriving guests. The wireless infrastructure can be used to implement curbside check-in; pioneered at large conference facilities such as the Opryland hotel in Nashville, TN (Anonymous, n.d.), this use of technology offers the possibility to check in arriving guests immediately upon arrival. This way, guests can be on their way to the room without even having seen the front desk. Alternatively, satellite check-in or check-out stations can be provided throughout the hotel's public areas for convention or non-convention guests without having to worry about wiring issues, as these stations can also make use of the wireless infrastructure.

Bellpersons can use wireless devices to tag the guests' luggage or even to reassign rooms in case the guests are not completely satisfied with an assigned room. With a handheld device connected to the PMS, the bellperson can check on the status of alternative rooms and change the assignment in the system without having to call the front desk for assistance. Furthermore, the bellpersons have the possibility to show more expensive rooms to the guests, thereby creating opportunities for upselling and increasing revenue. Similarly, room service employees can carry handheld devices, enabling them to submit additional orders to the kitchen in real time while delivering the original order. The need for paper receipts is eliminated when the guest has the opportunity to sign the room service bill directly on the handheld device; this further helps to increase efficiency and to lower the error rate in the billing process, as the completed order can be directly charged to the guest's folio in real time.

2.2 Use of Wireless technologies to Provide Internet Access

Today, many business travelers are carrying their laptop computers on business trips in order to be connected while on the road; if a hotel does not offer high-speed Internet connectivity, the guests typically use the hotel's telephone system to establish a dial-up connection to their Internet Service Provider (ISP). One use of PBX systems in hotel properties is to maximize the efficient use of a hotel's outside lines; as the number of outside lines needed simultaneously almost never equals the number of telephones installed in the guest rooms, a PBX system can be used to route internal, incoming, and outgoing phone calls so that the outside lines are utilized in the most efficient way. Typically, the number of trunk lines equals 10-15% of the number of hotel rooms (Marsan, 1999). However, the use of dialup Internet connections can lead to capacity problems of the hotel's PBX system and trunk lines that connect the PBX to the local telephone provider, especially during in the evenings. The number of outside lines needed for a given property is usually based on the assumption that the guests conduct regular voice telephone calls, which are mostly of short duration. The use of telephone lines to connect to the Internet has changed this assumption, as the guests tend to utilize the hotel's outside lines much longer when connected to the Internet; this tendency might be increased if the hotel offers free local or toll free calls (Marsan, 1999). In this case, laptop users can enjoy the comfort of a (slow) "always on" connection in their hotel rooms (especially if two phone lines are provided). This traffic can easily fill the capacity of the hotel's outside lines, leading to frustration of guests and potentially of hotel employees without generating additional revenue (Marsan, 1999).

Wireless Internet access can effectively deal with these issues, as guests can access the Internet or their email without having to rely on phone lines. Some hotel chains provide the necessary equipment to their guests, so even guests lacking the necessary equipment can utilize wireless access. However, excessive use of the wireless infrastructure can create guest dissatisfaction due to bandwidth limitations; if too many guests are using the infrastructure simultaneously, the bandwidth available to each guest can drop significantly. Nevertheless, providing wireless Internet access is a viable alternative for existing, older properties, as well as newly built hotels. Older hotels can provide fast Internet access to their guests without having to re-wire the entire property; additionally, wireless accessibility provides further flexibility for business travelers, who can use their laptop without being bound to the next data port. The following section will discuss factors influencing a hotel's decision of whether or not to use this technology.

3 THEORETICAL MODEL

The deployment of WLAN technologies in hotel properties depends on a number of factors; these can be broadly classified as organizational, technological, and social factors. Figure 1 displays different factors influencing the adoption of WLAN technology in the hospitality industry.

3.1 Organizational Factors

Two important organizational factors influencing WLAN technology adoption are ownership structure and branding. If the primary uses of the technology are enhancing revenue or providing guest service, branded properties might face pressure from the brand to deploy certain infrastructures; depending on the strategic plan of the brand, the individual property might be obliged to install wireless technologies (Hartmann 2004). If the use is for increasing efficiency, the management company might be the driving force for implementing this technology. In both cases, the hotel owners will have to be convinced of investing in this technology.

The market orientation of the hotel property is another important factor influencing the decision to set up WLAN infrastructures if the goal is to provide wireless Internet access to the guests. While in the long run, wireless devices become more ubiquitous, at present, a wireless network would be most

useful for business travelers who possess the necessary equipment, such as wirelessly enabled PDA's or laptops. In case the WLAN is to be used primarily for enhancing productivity and efficiency, such as using wireless technologies for check-in staff, bellpersons, or housekeepers, the market orientation is much less of concern.

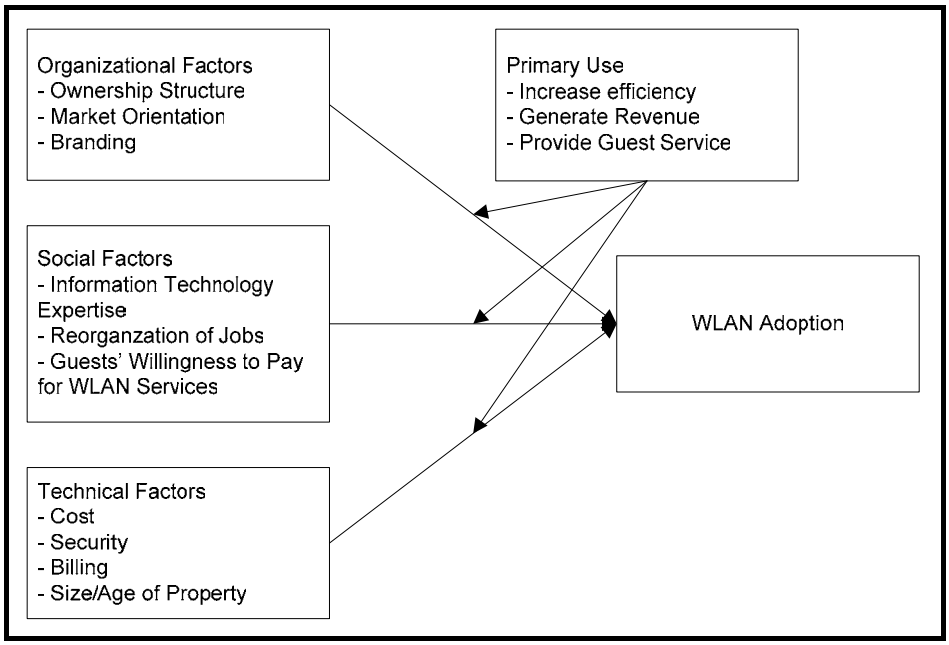

Figure 1. Different factors influencing the adoption of WLAN technology

3.2 Social Factors

In this section, the social and sociotechnical factors inhibiting or facilitating WLAN technologies will be discussed. As mentioned above, independently owned and operated properties might not have the technical expertise in setting up the necessary infrastructure. Outsourcing provides a way to overcome this shortcoming, as different providers can offer their expertise to recommend and set up the appropriate systems; however, while outsourcing providers certainly can make recommendations, it is questionable whether these are always in the hotel's best interest. The integration of information systems courses into hotel school curricula might help to alleviate this problem in the long run.

One important use of WLAN infrastructures is increasing efficiencies by implementing curbside check-in, or by equipping housekeeping supervisors, room service employees, and bellpersons with handheld devices to be used for their respective purposes. In many cases, this means changing existing job descriptions for employees; for example, bellpersons' responsibility will increase when given access to the hotel's PMS. This job enrichment might create problems such as the dilemma of giving tipped employees the authority to change room assignments. Furthermore, this could create resistance by front desk employees fearing loss of their authority in terms of room assignments or upgrades.

The provision of wireless broadband Internet access can be used to deliver superior guest service as well as to enhance the hotel's revenue. Many hotel properties have adopted the airports' business model, namely, charging a usage based fee for this service. Usage can be measured either in hours or days of usage, or in data transfer, and the guests can be charged accordingly. Providing a way to generate revenue might facilitate persuading hotel owners to invest in this technology. On the other hand, guests might not be willing to pay for these services and switch to a competitor. Therefore, management needs to decide carefully about whether or not to use this technology to generate revenue; although it can be used to create high revenues at a low incremental cost per user, providing

free high-speed Internet access can greatly increase guest satisfaction. Depending on the competition, hotels might not be able to charge for WLAN access; in the long run, wireless Internet access might become something guests expect to get for free, similar to free local phone calls in many properties.

3.3 Technical Factors

For many properties, cost is an important consideration, no matter whether the WLAN infrastructure is primarily used to increase efficiency, provide guest service, or to generate revenue. Many older hotel properties are not wired for providing high-speed Internet access, so choosing a wireless network is a cost-efficient alternative. Although setting up the wireless infrastructure means retrofitting the property with additional cables for hubs, routers, and access points, it saves the cost of wiring every single guest room for high-speed Internet access. From an efficiency standpoint, the adoption of wireless technologies primarily makes sense for hotels with a large number of rooms, or for resort hotels, where the rooms are often spread out over a large area. For small properties, there will be less incentive to invest in this technology for the purpose of increasing efficiency. However, if the WLAN is to be used to provide access to the Internet for the guests, size of a property might not be a concern.

Depending on the use of the infrastructure, security concerns will differ; in case the infrastructure is only to be used internally, the system has to be secured from outside intruders. When using the infrastructure in a parallel way for both guests and employees, separating network traffic is more critical; a good option would be to create a shared WLAN infrastructure, e.g., by using access points supporting multiple service set identifiers (SSIDs; Geier, 2004).

If the WLAN is used for generating revenue by charging guests for Internet access, the hotel management has to be careful to choose a system that allows for accurate billing for the service. In many cases, outsourcing the infrastructure might be a good solution, as the hotel does not have to deal with billing-related issues (although many guests will nevertheless first contact the hotel property with billing related questions).

In the following paragraphs, we will discuss a framework that can be used to analyze adoption decisions for wireless LANs. This discussion will be followed by a conclusion and a discussion of avenues for future research.

4 A COST ANALYTIC FRAMEWORK

Given that a hotel has decided on the primary use of its WLAN adoption, we can consider an adoption decision represented by a model with three decision variables as vectors:

X_o = Organizational Factors, including ownership, size, brand
X_s = Social factors, including expertise, job reorganization, and WLAN demand
X_t = Technical factors, including security, pricing, property age and size.

We assume that the decision matrix is continuous rather than discrete, restricted to a set S that reflects all possible decision outcomes, given general constraints.

Let V be a function that maps specific combinations of the vectors to show the value of the adoption. For hotels, this value could be the approximate measure of the net present value of future cash flows. The decision (D_v) is desired so that it maximizes the value of the firm based on decision variables:

$$D_v = argmax\ V(X_o, X_s, X_t), \text{ where } X \in S$$

Furthermore, each of the factors is again a function of the benefits (B) derived from the inclusion of each sub-factor (i) and its associated cost (C). Each sub-factor is assigned a weight (w) by the organization. For example, a particular type of ownership, firm size, or brand has both advantages and disadvantages. Similarly, expertise in adopting and implementing WLAN is beneficial but acquiring the expertise has a cost.

$$X_o = f(B_{Xo}, C_{Xo});\ X_s = f(B_{Xs}, C_{Xs});\ X_t = f(B_{Xt}, C_{Xt})$$
$$\text{where } B_X = \sum w_i B_{Xi} \text{ and } C_X = \sum w_i C_{Xi}$$

The underlying value function for the decision D_v is shown as an approximation of the cash flow model (Karmakar & Rummel, 1990; Rummel, 2000) that allows us to recreate the present value of a decision schedule given the decision variables.

K = index of the discrete number of installation iterations ($1,...K_s$) performed for each WLAN setup; the discrete numbers can be determined by the number of site visits and schedules assigned before each instance of WLAN is operational in a hotel (note that every installation iteration in a Hotel is equated to inconveniences to clients, minimal iterations are always welcomed).
T = index of decision variables (X_o, X_s, X_t).
C_X = cash outflow from associated with a particular organizational factor.
B_X = cash inflow associated with a particular organizational factor.
T_{nk} = cash outflow associated with the setup of WLAN instances in a particular hotel.
A_τ = time WLAN will keep providing benefits given existing decision variables. This could be determined by the expected time period after which WLAN could be outpaced by another technology.
B_τ = time WLAN costs will be incurred or period of cash outflows given existing decision variables.
Z_τ = time at which WLAN setup k occurs in hotel site s.
d = discount rate for cash flows as determined by individual hotels.

The WLAN adoption decision could be embodied by the present value of future cash flows:

$$\sum(B_X e^{-da_\tau} \mid X_o, X_s, X_t) - \sum (C_X e^{-db_\tau} \mid X_o, X_s, X_t) - \sum^S \sum^K (T_{nk} e^{-dz_\tau} \mid X_o, X_s, X_t)$$

The simulation model of the adoption decision is based on assumed functional forms for costs, benefits, and setup iterations. The relationship between an adoption decision and benefits (B_X) is assumed to have a semilog functional form ($\beta>0$): adoption decisions would show a bandwagon effect and positive network externalities; the relationship between an adoption decision and costs (C_X) as a quadratic function ($\beta<0$): related to the law of diminishing returns where hotels may be willing to bear the cost burden to a certain degree but further costs would weigh negatively on adoption decisions; and the relationship between an adoption decision and setup iterations (T_{nk}) as a reciprocal function ($\beta<0$): adoption decisions would be extremely elastic to the number of setup iterations and management would not adopt WLANs if the number of setup iterations were too many. The resulting adoption function is shown in Figure 2 with the area demarcated by a, b, c implicating the parameters for adoption of WLANs.

5 CONCLUSION

This paper presents a cost-analytic framework highlighting the factors influencing the decision to adopt WLAN technologies for the purposes of increasing efficiency, enhancing guest service, or generating revenue. The next step is to suggest the decomposition of the approximation scheme used as an objective function, with a stronger eye for detail. The constraints posed by the sub-factors within each decision variable need to be investigated further. A simulation model will be introduced and used to find optimal decision solutions. Once the optimal framework is derived, it could be used to potentially unravel adoption decisions of other emergent technologies that firms (including the hospitality industry) constantly grapple with. With the emergent of new technologies, this analytic framework could be used by firms as an economic rationale as opposed to a mere bandwagon effect in their adoption decisions.

Whereas we believe that the current framework is valuable for analyzing adoption decisions, many adoption decisions seem to be driven primarily by corporate strategy, as is the case with WLAN implementation at McDonald's (Wrolstad, 2004), or the hotel companies Marriott or Hilton (Hartmann, 2004). Thus, a survey of branded and unbranded hotel properties could shed light on the factors influencing WLAN adoption in the different case and could be used to test the current model.

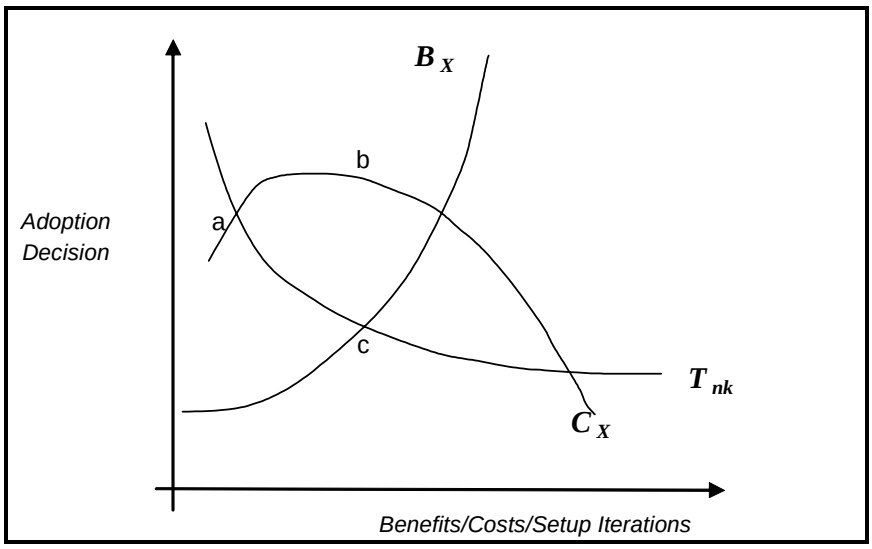

Figure 2. Adoption function for WLANs

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